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**Low Flow Purging and Sampling Procedure for the Collection
Of Ground Water Samples from Monitoring Wells
Revision 2
June 2012**

1.0 SCOPE AND APPLICATION

This procedure provides a framework for collecting ground water samples using a low stress (low flow) purging and sampling method. This SOP emphasizes the need to minimize stress by low water-level drawdowns, and low pumping rates (usually less than 1 liter/min) in order to collect samples with minimal alterations to water chemistry. This SOP is aimed primarily at sampling monitoring wells that can accept a submersible pump and have a screen, or open interval length of 10 feet or less (this is the most common situation). However, this procedure is flexible and can be used in a variety of well construction and ground water yield situations. Samples thus obtained are suitable for analyses of ground water contaminants (volatile and semi-volatile organic analytes, pesticides, PCBs, metals and other inorganics), or other naturally occurring analytes.

2.0 SUMMARY OF METHOD

Each well is tested to determine the appropriate pumping rate to obtain stabilization of field indicator parameters with minimal drawdown in the shortest amount of time. The mid-point of the water depth is used as the location of the pump intake. Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of stable drawdowns of less than 0.3 feet, while desirable, is not mandatory. Sample collection may still take place provided the remaining criteria in this procedure are met.

3.0 LABORATORY NOTIFICATION PROCEDURE

The Project Manager for any Monitoring Well sampling event is required to communicate with the laboratory staff about the following:

- Proposed sample dates and time that samples will be delivered to the lab must be communicated by email to all lab staff members and the lab supervisor.
- Upon approval by the lab, the PM will write the sample dates, times of sample arrival and sample sites on the white board in the general chemistry lab; for example: "June 4th, MW101 and MW103, samples delivered by 3:00 PM".
- Fridays are typically considered "no sample delivery" days in the lab so any sampling planned for a Friday must have lab supervisor approval prior to any sampling activity.
- Sterile Microbiological samples must be delivered to the microbiology analyst immediately upon delivery in the lab (these samples have a two-hour holding time).

4.0 SAFETY

- Always sample in pairs. No Monitoring Well sampling shall occur with only one sampler.
- Prior to sampling, all samplers will attend safety training with the Quality Assurance Coordinator which will cover topics such as: dealing with wasps and black widows, City Easements, Safety hazards and field conditions.
- Always carry at least one cell phone while working in the field.

5.0 EQUIPMENT AND SUPPLIES

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- Adjustable rate, submersible pump constructed of stainless steel: Proactive Environmental Products, "S.S. Monsoon", Serial #2820
- Teflon lined polyethylene tubing; ¼ inch or 3/8 inch (inner diameter): ECT Manufacturing Inc., Teflon Lined Poly Tubing. Order from Environmental Equipment and Supply, Catalog #48915
- Power Source: Interstate Battery, "Deep Cycle Marine/RV", Model SRM-24
- Water level measuring device capable of measuring to 0.01 foot accuracy: Slope Indicator Co., "Water Level Indicator", Serial #18192
- Flow measurement supplies
 - 1 or 2 liter plastic beaker
 - Timer or watch
 - Calibrated field pH/temp meter
 - Calibrated EC (specific conductance) meter
- Field log book
- Dissolved Oxygen Meter (Alpha Farm only)
- Total Residual Chlorine Meter (Alpha Farm only)
- Sample bottles
- Sample coolers packed with ice or refrigerant

6.0 Monitoring Well Sample Sites and Locations

Drive to the nearest landmark listed below. Turn on the GPS unit (DeLorme PN-60). Wait 3-5 minutes for the device to fix its location against the satellite signals. Press the "MENU" button and using arrow keys move the cursor to "Waypoints" then press "ENTER". Use the arrow keys and highlight the well you are looking for (labeled Mw 101, Mw 102, etc.) and press "ENTER". Next, using the arrow keys highlight "Route" and then press "ENTER". Lastly, make sure "Navigate" is highlighted and hit "ENTER" again. Choose the "Hike" option and press "ENTER". You should now be on the map screen. The triangle is your location and indicates your direction of travel. The orange line indicates the direction to your destination. You can use the "IN/OUT" buttons to zoom in and out of the map and can scroll through the map using the arrow keys. The GPS will inform you when you have arrived at your destination.

- MW 101: Alpha Farm - main entrance. Farthest west well. Near preserve boundary.
 - **N 38° 23'10.22" X W 122° 47'30.75"**
- MW 102: Alpha Farm - main entrance. Just past biosolids storage area.
 - **N 38° 23'23.81" X W 122° 47'15.02"**
- MW 103: Alpha Farm - just north of Roseland Creek. Near the road.
 - **N 38° 23'32.06 X W122°46'39.71"**
- MW 104: 1645 South Wright Rd. Western fenceline on LaFranchoni Tomato Farm. (George 703-8422)
 - **N38°24'22.86" X W122°46'16.55"**
- MW 105: Kelly Farm – gate near Piezzi Lane. On fence line just east of Live Oak Street.
 - **N38°25'23.66" X W122°47'57.63"**
- MW 106: Kelly Farm – 5344 Occidental Road; Main gate – near trees where road splits.
 - **N38°25'04.37" X W122°48'33.06"**

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- MW 107: Kelly Farm – Main gate; take right fork to the end at the walking trail. South along fence line.
 - **N38*24'40.60" X W122*48'45.05"**
- MW 108: Dei Dairy – High School Road. Drive through dairy down to the Laguna. (Dale 889-1395)
 - **N38*24'47.09" X W122*49'01.94"**
- MW 109: Dei Dairy – High School Road. Near the house. Well top is flush with the driveway.
 - **N38*24'36.86" X W122*49'37.62"**
- MW 110: Willowside Road just north of Santa Rosa Creek. Enter Hansen gate and drive frontage of vineyard.
 - **N38*24'47.41" X W122*49'02.07"**
- MW 111: Guerneville Road at fence line between pasture and horse ranch.
 - **N38*27'09.02 X W122*47'34.41"**
- MW 112: 2940 Guerneville Road - Rasmussen Vineyard – Drive south and then west
 - **N38*26'45.74" X W122*47'17.16"**
- MW 113: Gallo
 - **Well shaft currently broken – no sampling here.**
- MW 114: Gallo
 - **N38*19'04.03" X W122*43'01.59"**
- MW 115: Alpha Farm – Just north of Roseland Creek near the pond.
 - **N38*23'28.52" X W122*46'43.89"**

Add Jacobsen Wells and Outfall sites here

7.0 WELL DEPTHS AND SPECIAL SAMPLING CONSIDERATIONS

- MW101: Depth 39.2 feet
- MW102: Depth 36.3 feet
- MW103: Depth 43.4 feet
- MW 104: Depth feet; Must call George at 703-8422 to schedule sample date and approx time.
- MW 105: Depth 47.0 feet
- MW106: Depth 47.0 feet
- MW107: Depth 29.1 feet; Have not been able to sample here for several years due to low water level. This well is usually visible in the Spring but by Fall may be covered by blackberry bushes. Bring pruners or string mower to gain access.
- MW108: Depth feet; Must call Dale at 889-1395 to schedule sample date and approx time.
- MW109: Depth 61.0 feet; Must call Dale at 889-1395 to schedule sample date and approx time (located at Dei Dairy – same as MW108).
- MW110: Depth 35.9 feet
- MW111: Depth 46.7 feet
- MW112: Depth 27.9 feet
- MW113: Well shaft is broken so cannot sample until repaired (Gallo Vineyard)

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- MW114: Depth 37.5 feet (Gallo Vineyard)
- MW115: Depth 90.3 feet

8.0 MONITORING WELL EQUIPMENT BLANKS

See Field Quality Control section of this SOP for equipment blank collection procedure and required frequency for collecting equipment blanks.

See Monitoring Well Analysis Schedule (U\Lab\SOP\Sampling SOPs\Ground Water) for a complete list of analytes and required bottles for equipment blanks.

9.0 TEMPERATURE BLANKS

All samples, except for metals samples, must be stored in coolers packed with ice immediately after sample collection. Included in each cooler must be a temperature blank bottle. This bottle must be either 500 ml or 1000 ml plastic and be labeled "temperature blank". The temperature blank is the last sample collected once a cooler is full – it is used to check the cooling process of the samples before they are delivered to the lab. Use the pH/temp meter to measure the temperature of the temp blank and document in the MW log book as "initial temp". Also document the time that the temperature blank was collected.

When samples are delivered to the lab measure the temperature blank and document both the initial temperature and temperature at receipt into the lab on the sample Chain of Custody. Samples should be $\leq 6^{\circ}\text{C}$ but not frozen. If the temperature blank is above this limit, the initial temperature will show that samples were "in the cooling process" which is sufficient to be in compliance with EPA regulations.

10.0 PRELIMINARY SITE ACTIVITIES

- Check each well for security damage or evidence of tampering. Document pertinent observations in field log book and report any damages to the Quality Assurance Coordinator.
- Remove iron well cover.
- Remove well cap (unscrew).
- A static water level measurement must be performed before any purging and sampling activities begin. It is recommended that water level depth (to 0.01 ft.) and total well depth (to 0.1 ft) be measured as soon as possible after arriving at the site so that any turbidity caused by the measurement can settle back to the bottom of the well. Care must be taken to minimize water column disturbances (try to keep the measuring device from scraping against the sides of the well).
 - **Determine static water level**
 - Drop water level indicator guage into the well
 - Turn dial on to #10
 - Lower cord until instrument buzzes
 - Note cord placement on top of well casing – take reading off of cord.
 - Document static water level in field log book.
 - **Determine mid-point of water column**
 - Drop water level indicator guage to the bottom of the well; line will feel slack when the bottom is reached
 - Sampling should occur at mid-point of the water column but not exceed 10 feet below the top of the column.

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- To determine mid-point, subtract top water level from total water level and divide by two. For example, if top water level (static water level) is 8 feet down and bottom of well is 18 feet down: $18 - 8 = 10$; 10 divided by 2 = 5 feet. Sampling should occur at 5 feet below the top water level.

11.0 PURGING AND SAMPLING PROCEDURE**A. Install Pump**

- Attach tubing to pump.
- Simultaneously lower pump and water level indicator gauge to desired water level.
- When the desired water level is reached remove the water indicator level gauge.
- Attach the flow controller (voltage output) to the pump.
- Attach the alligator clips to the battery: Negative (black) terminal first, then the positive (red) terminal.

B. Purge Well

- Turn on the flow controller (voltage output) to the lowest speed possible and slowly increase the speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.
- Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump (for example, 0.1 – 0.4 liter per minute) to ensure stabilization of indicator parameters. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time.
- During pump start up, drawdown may exceed the 0.3 feet target and then “recover” as pump flow adjustments are made.
- The final purge volume must be greater than the stabilization drawdown volume plus the extraction tubing volume.

C. Monitor Indicator Field Parameters

- During well purging, monitor indicator field parameters (temperature, pH and specific conductance) about every five minutes.
 - **NOTE:** During the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress and recording those adjustments. Start indicator field parameter monitoring once pumping rate is stable.
- Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at a minimum of five minute intervals, are within the following limits:
 - Specific conductance: +/- 3%
 - Temperature: +/- 3°
 - pH: +/- 0.1 pH unit
 - All measurements must be obtained using field equipment that has been calibrated at the beginning of each sampling day.

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- During purging and sampling the tubing should remain filled with water so as to minimize possible changes in water chemistry upon contact with the atmosphere.
- Fill all sample bottles by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.
- VOC (volatile organic compounds collected in 40 ml VOA vials) samples should be collected first and directly into pre-preserved containers. Semi-volatile organics should be collected next. Then, proceed to all other samples.
- If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter is required and the filter size must be 0.45 um. Pre-rinse the filter with approximately 25-50 ml of ground water prior to sample collection. Collect filtered water samples directly into pre-preserved containers.
- Label each sample with date and time collected, site ID and collector's initials.
- Place samples into a cooler with ice or refrigerant for delivery to the laboratory. Metals samples after acidification to a pH less than 2 do not need to be cooled.
- Collect one ground water temperature blank per sample cooler (see Quality Control section below).
- Replace Screw Cap and Iron Well Cover!

12.0 DECONTAMINATION PROCEDURE

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. The pump and tubing (including support cable and electrical wires which are in contact with the well) must be decontaminated according to the following procedure.

- Submerge pump in bucket of deionized water and shake/swirl pump to remove particulates.
- Flush pump and tubing with at least 4 liters of deionized water.
- Flush out all water from pump and pump tubing.

13.0 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular monitoring samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch may not exceed one sample collection day or 20 samples).

- Field duplicates: Field duplicates are collected to determine precision of the sampling procedure. For this procedure, collect duplicate samples for each analyte group in consecutive order (VOC original, VOC field duplicate, semi-volatile original, semi-volatile duplicate, etc.).
 - Collect field duplicates at one monitoring well per sampling day. NOTE: field duplicates are not required for Alpha Farm Monitoring Wells or Gallo Monitoring Wells.
- Equipment Blank: Equipment blanks shall include the pump and the pump tubing. Collect equipment blanks in the lab using Millipore water after decontamination procedure is completed.
 - Spring Monitoring Well sampling: Equipment blank is only required one time, before sampling commences.

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- Fall Monitoring Well and Alpha Farm Monitoring Well sampling: Equipment blanks are required before each daily sampling event.
- Trip Blank: Trip blanks are required for the VOC samples at a frequency of one per VOC sample cooler.
- Temperature Blank: Collect one ground water temperature blank per sample cooler. See Section 6.0 of this SOP for instructions.

Field Log Book: A field log book shall be kept to document all ground water field monitoring activities – every well must have a page in the log book for Spring and Fall even if the well was not sampled. If the well is not sampled, document the reason why and fill out a Chain of Custody for each well. On the C of C for wells not sampled document “not sampled” so that this information shows on the lab report. Record all of the following in the field log book:

- Monitoring well identification
- Well depth, and measurement technique (water level indicator gauge)
- Static water level, date, time and measurement technique
- Well drawdown
- Indicator parameters values and clock time at the appropriate time intervals
- Well sampling sequence and time of each sample collection
- Field observations during sampling event including weather conditions, any nearby fires, use of wasp or bug spray, absence of iron cap or screw cap, etc.
- Name of sample collector
- QA/QC data for field instruments: calibration date/time and calibration range
- Any problems encountered should be highlighted

14.0 REFERENCES

- Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells; US EPA Region 1, July 30, 1996 Revision 2
- 40 CFR 136

SOP UPDATES

Reviewed 7-20-11: no changes (Previous Date May 2010) C. Kaul

New Revision (Rev 2): added Laboratory Notification Procedure – Section 3.0 June 3, 2012 C. Kaul